USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

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Title: Detection of E. coli in Source Water Using a Novel Biosensor

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Abstract

It is highly desirable for monitoring the water quality in a real-time manner. EPA recommends E. coli as the best indicator of health quality standards. By observing E. coli bacteria, the increase or decrease of many pathogenic bacteria can be estimated. In Alabama, lots of families use their private wells as the primary water source. The quality of water from these wells is a big concern from a public health view. Alabama is rich in source water, such as Lake Martin and many rivers/creeks. The quality of source water is the key to ensure the quality of drinking water. Therefore, monitoring the quality of source water would be very critical. The data from water quality monitoring is also very critical to determine the source of pollution and would help the local farmers use the land more efficiently. An inexpensive biosensor/technology that is suitable for field testing is urgently needed for monitoring the quality of source water in a real-time manner.

Although methods exist for identification of E. coli and many microbial strains in water, determination of the numbers of microbes that actually exist in a given sample still remains a great challenge when the microbes are present at relatively low cell counts. Recently, we developed a novel type of biosensors based on magnetostriction, which is capable of detecting a few bacteria in a few minutes. The new technology has many advantages over the existing technologies, such as high sensitivity, working well in water, easy to deploy, very inexpensive, suitable for field testing. All the advantages of the new technology have been experimentally demonstrated by the biosensor for detecting s. typhimurium bacteria and B. anthracis spores.

The technology is based on the magnetostrictive particle (MSP) as the sensor platform and antibody/phage as the receptor. The receptor captures the target bacteria, which results in a change in the resonance frequency of the MSP. The resonance frequency of the MSPs can be remotely/wirelessly determined. That is, the MSP sensor is a wireless sensor.

In the proposed research, we propose to develop the MSP biosensor for detecting E. coli bacteria in source water without pre-treatment for field testing in a rel-time manner. the commercially available antibody against E. coli will be immobilized onto the surface of the MSP as the receptor.

Successful development of the proposed biosensor would advance monitoring water quality and contribute to the public health of the country as a whole.